

Learn to Design and Verify a 6-stage pipelined RISC-V CPU

Rishiyur S. Nikhil, Cofounder and CTO, Bluespec, Inc.

October 22, 2025

Tutorial at Developer's Day, RISC-V Summit, Santa Clara CA

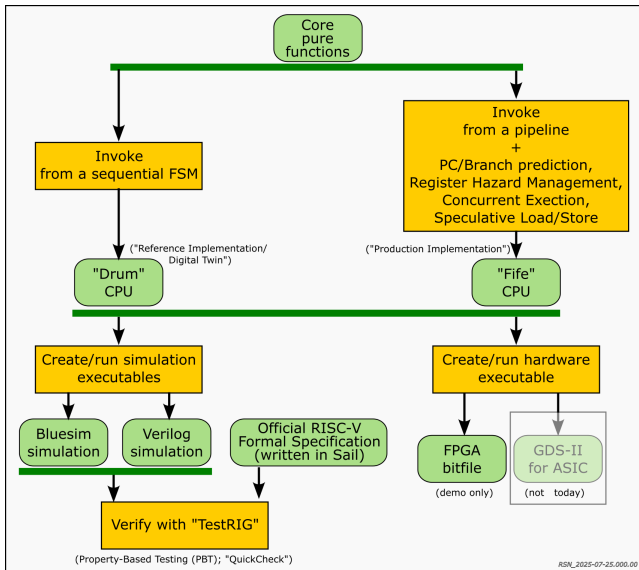


PLACEHOLDER

This is a placeholder for the slide deck which will be used at the tutorial.

It will be replaced by the final slide deck shortly before the actual tutorial on October 22, 2025.

The Plan for Today



"Hands on":

- We will read the code together
- We create and run simulation executables together
- We will verify the design together

(If you haven't installed the tools yet, please just listen and follow; hopefully you will try everything on your own, later)

Not "Hands on" (lecture and demo only):

- How to build and run on FPGA

"But I'm not familiar with hardware design" or
"I'm not familiar with the language used" ...
... don't worry:

- For "Core pure functions" and **Drum**, the code looks just like a conventional programming language
- **Fife** will introduce pipelining and pipeline techniques; we will explain the code in more detail.

Prerequisites

We *do* assume that you are familiar with:

- Some ISA (Instruction Set Architecture): Machine Instructions and/or assembly-language (RISC-V or other).

We're not going to explain what is a general-purpose register, what is a Program Counter, what is an arithmetic instruction, what is a BRANCH or JAL/JALR instruction, what is a LOAD/STORE instruction, etc.; we're assuming you already know these things.

- General coding (in C, Python, Go, Rust, Haskell, Verilog, SystemVerilog, ... whatever), so you can quickly grasp new, unfamiliar code.
Familiarity with enum and struct types, functions, if-then-else.
General knowledge of object-oriented programming is useful.

We *do not* assume that you are familiar with:

- Hardware design, or any hardware design language (Verilog, SystemVerilog, Bluespec BSV or BH, Chisel, ...)
- Pipelined micro-architecture of CPUs

On the Tutorial Web Page (https://github.com/rsnikhil/Tutorial_RISCV_Summit_2025), we've asked you to install certain tools so that you can examine code and build and run things along with me during this tutorial.

If you haven't done this already, then please just sit back and follow the lecture and demos, for now. We hope that you will be motivated to later install the tools and try everything out for real.